4

WATER CONSERVATION

The Bear River Basin's cities, towns and industries generally enjoy an adequate water supply. Even as far ahead as the year 2050, most municipalities in the basin have enough water to meet their projected water needs or have an option available to acquire the needed water. For many of these communities the question has not been "When to develop and implement a water conservation plan?" but "Why?"

Drought conditions plaguing the northern portion of the state since 1999 have served as a wake-up call for many Bear River Basin communities and agricultural water users. Water conservation by municipalities in the basin should be implemented as a way of life or an ethic, not merely as a drought-mitigation tool.

THE BENEFITS OF WATER CONSERVATION

The primary objective and resultant benefit of water conservation is the reduction of water demand, thus allowing existing water supplies to last longer. In addition, water conservation has a number of important secondary benefits. Water conservation can:

- Delay capital investments to upgrade or expand existing water and wastewater facilities;
- Conserve energy as less water needs to be treated, pumped and distributed to the consumer;
- Lessen the leaching of chemicals and sediments into streams and aquifers through improved efficiencies;
- Reduce stream diversions, enhancing water quality as well as environmental and recreational functions; and
- Improve water levels in reservoirs for recreational use

UTAH'S WATER CONSERVATION EFFORT

A statewide goal has been established to reduce per capita water demand within public community systems by at least 25 percent before 2050. To guide the management of water development projects, the Board of Water Resources has issued a policy statement supporting conservation and the "wise use" of water. The Board's policy requires communities petitioning them for project funding to: (1) develop a water conservation plan, (2) establish a time of day watering ordinance, and (3) develop a progressive water rate structure.

Water Conservation Plans

The state's Water Conservation Plan Act requires all water conservancy districts and water retailers serving more than 500 connections to prepare Water Management and Conservation Plans. These were to be submitted to the Division of Water Resources by April 1999 and are to be updated every 5 years. These plans should present effective water conservation measures that can be employed to reduce municipal water use. Leak detection programs are recommended to find other unmetered water that is lost in the system. For most communities, unmetered losses will probably go unchecked as long as the existing supplies are adequate. Competent planning helps water system managers foresee the crises and reduce system losses through metering and system maintenance. Also, programs that improve the efficient use of water on large landscapes, such as parks, schools, and cemeteries, can realize significant water reductions

through careful planning and management without sacrificing aesthetic appeal.

Governor's Water Conservation Team

The Governor's Water Conservation Team's web site (www.conservewater.utah.gov) is hosted by the Utah Division of Water Resources. This informative web site contains many features that are designed to help Utahns use water inside and outside their homes wisely. Some of the web site's features include: a monthly lawn watering recommendation, a customizable landscape watering guide, a comprehensive list of tips, a water conservation events calendar, and copies of the team's radio and TV ads promoting conservation.

Studies

The Utah Division of Water Resources conducts studies to assess water demand so that baselines can be established and progress towards the state's water conservation goals can be tracked. A multi-family residential water demand analysis is also being conducted to determine how water is used indoors in apartments, condominiums and other multi-family settings. These numbers will be beneficial because they can be used to generalize indoor water consumption rates.

A wide range of water conservation methods have been employed in various regions of the arid western United States. The practices used in other western states are often applicable to Utah. Studies are underway to test the adaptability of specific practices to Utah conditions. For example, the division has an irrigation controller study underway. The new controller has been installed in a few homes in the Salt Lake Valley to assess its water saving capabilities. The controller incorporates evapotranspiration (ET) rates into each irrigation zone's specific parameters, and recalculates an efficient irrigation schedule each time it receives the localized evapotranspiration rate from a satellite. This study will make it possible for the division to predict water savings from the installation of ET-based irrigation controllers.

A 1995 publication of the Utah Water Conservation Advisory Board offered a number of programs and suggestions for effectively conserving M&I water. These recommendations include: 1) development of water management and conservation plans by major water provider agencies, 2) reduction of water use by replacing high water consuming landscaping with xeriscaping or landscaping with reduced water needs, 3) better overall management of water intensive businesses and large conveyance systems, and 4) implementation of incentive based water pricing policies.

WATER CONSERVATION MEASURES

An effective water conservation program should contain a variety of water-saving measures, including incentive pricing, ongoing leak detection and repair programs, commercial and residential water use audits, and an effective water metering program. But the most effective residential water use program that can be implemented in the basin, and throughout the state, is to decrease the over-watering of residential, commercial and institutional landscapes. Most Utah residents over-water their landscapes by 20-50 percent. Local water conservation programs should emphasize the reduced use of water on landscapes.

Indoor Conservation

Since lawns and gardens are dormant during the winter months, Utahns have ample opportunity to focus on indoor water conservation. Residents can install water-saving toilets and showerheads, and check plumbing for leaks. Newer large appliances, such as washing machines and dishwashers are designed to use less water than older models. Even so, automatic dishwashers and washing machines should be run only for full loads. Residents can also avoid running faucets unnecessarily for shaving, brushing teeth, or rinsing vegetables, dishes, and other items.

Outdoor Conservation

Outdoor landscape irrigation accounts for about two-thirds of all residential water use. This water can be supplied by either the culinary water system or a secondary water system. Secondary supplies reduce the demand for the more expensive culinary quality water, thereby reducing overall water costs. However, the use of secondary water does not reduce overall water use. In fact, the availability of un-metered, low cost, secondary water often results

Brigham City home with low-water use landscaping

in over-watering of the landscape. It is also recommended that, whenever feasible, secondary water systems should be metered.

Regardless of the cost, many people tend to over-water lawns and gardens as much as 50 percent. Studies have revealed that automated home sprinkler systems with timers result in the greatest over-watering of landscapes. Homeowners, who water by hand, dragging a hose and sprinkler, tend to water only the areas that need to be watered. Homeowners that have an in-ground sprinkler system that is manually operated tend to water only when the lawn appears to need water. However, many home owners with fully automated sprinkler systems tend to set the timer to provide enough water for the hottest days of the summer and then leave the system at that setting for much of the year.

Educating homeowners to periodically adjust their irrigation system's application rate to coincide with seasonal weather changes can achieve significant water savings. Perhaps a more effective measure is to replace the system controller with a more sophisticated device capable of automatically adjusting the application rate to reflect seasonal-changing landscape water needs. Conservation measures that do not require the homeowner to adjust their habits are easier to implement and are more effective. Irrigation controllers linked with a local weather station that automatically adjust application rates to the water requirements of the landscape are a good way to implement water efficiency practices without changing personal water use habits. These types of measures are called "hard fixes", and also include replacing or repairing broken sprinkler heads, improving system uniformity, or maintaining proper irrigation pressures.

Water conservation can also be achieved by changing residential landscaping paradigms. Grass areas should be designed so they are easy to care for, will actually be utilized, and can be irrigated efficiently. The Utah State University Extension Service has information on low water consuming plants and vegetation that in many instances offer a suitable alternative to grass. Individuals interested in implementing any of these types of water conserving landscapes can get ideas from the Center for Water-Efficient Landscaping at Utah State University, the demonstration landscapes at the Greenville Farm Demonstration Garden (1800 North 800 East, Logan), the Utah State Botanical Gardens in Kaysville, or the Jordan Valley Water Conservancy District in the Salt Lake Valley.

The Division of Water Resources encourages water conservation through low water-use landscaping often referred to as xeriscape. Principles of xeriscape include limiting lawn areas, grouping plants with similar water needs, using plants adapted to local climate conditions, irrigating only when needed, watering during morning or evening hours, mowing the lawn at a longer length, and improving soils in shrub and garden areas by using mulches.

Metering

Accurate measurement of water is an important part of any pricing structure and encourages conservation in several ways. Not only is each user assured a fair and equitable distribution of resources, but it is also a more business-like way to operate a system and maintain records. When users pay according to the quantity of water they actually use, there is a built-in incentive to conserve.

Most community water systems are metered. However, properties such as city parks, golf courses, and cemeteries often are not. Metering all connections is an essential component in assessing the costs within a water system. Metering can also aid in water accounting, and can detect losses within the system. (See Chapter 5 for a discussion of metering secondary water systems.)

Incentive Pricing

Pricing policies are a means of reducing per capita water use. Uniform rate structures (a constant price for each unit of water) provide little incentive for consumers to conserve unless the price is set at a high level. Decreasing block rate structures (lower unit prices for larger volumes used) provide an incentive to increase use. "Take or pay" contracts, which provide water purveyors with a guaranteed revenue stream, do not promote conservation below the contracted amount of water. Increasing block rate structures provide a greater conservation incentive for consumers. Under this pricing policy, consumers experience an increasing unit price for higher water consumption. To be effective, the increase in price between blocks must be substantial.

Table 14 shows water rates for selected communities in the Bear River Basin. Communities such as Millville City and North Logan City show strong economic pricing policies, completely separating any variable water use from the base rate. Doing this allows the water agency to cover fixed costs through fixed charges on the water bill, and charge for variable use from per-unit charges on the bill. This type of rate structure allows a more accurate cost-of-service accounting and stabilizes revenue.

Assuming an average family of four and using the respective per capita use rates (See Table 12), the price per 1000 gallons of water for the selected communities of Table 15 range between $0.51 per 1000 gallons (Hyrum City) to $1.91 per 1000 gallons (North Logan City), with the average rate price of $.97 per 1000 gallons. See Table 15 for a detailed summary of the ratepayers cost per 1000 gallons for the selected communities. These numbers reflect average per capita water use and as such are representative of water use during the spring and autumn months of the year. Summertime water use rates, with heavy outdoor watering would be higher, while water use rates during the winter months would be lower.

Including more blocks within a rate structure is better economically and politically, as the consumer using large amounts of water will be paying the costs associated with that level of use. However, the increase between blocks must be substantial to encourage efficient water use. The increase from Block 2 to Block 3 in Providence City's pricing structure, from $0.65 per thousand gallons to $1.15 per thousand gallons, is a level of increase found effective in influencing water use. Inconsequential rate increases among blocks will have no significant effect on water consumption.

Setting water prices to encourage more efficient water use requires consideration of several principles. They are as follows:

TABLE 14
Water Rates for Selected Communities
All quantities measured in thousands of gallons (Gal)

Agency	Base Rate	Limit	Block 1	Limit	Block 2	Limit	Block 3	Limit	Block 4	Limit
Garland City	$12.75	15	$0.50	Unit	-	-	-	-	-	-
Hyde Park City	$26.00	10	$0.50	50	$1.00	Unlim	-	-	-	-
Hyrum City	$ 8.00	10	$0.45	50	$0.65	Unlim	-	-	-	-
Logan City	$ 8.95	3	$0.55	Unlim	-	-	-	-	-	-
Millville City	$17.00	0	$0.60	Unlim	-	-	-	-	-	-
Newton Town	$15.50	20	$0.30	Unlim	-	-	-	-	-	-
North Logan City	$ 7.11	0	$1.57	Unlim	-	-	-	-	-	-
Perry City	$15.50	15	$0.95	Unlim	-	-	-	-	-	-
Portage	$15.00	Unlim	-	-	-	-	-	-	-	-
Providence City	$19.25	10	$0.40	40	$0.65	60	$1.15	Unlim	-	-
Richmond City	$19.60	10	$0.72	Unlim	-	-	-	-	-	-
River Heights	$22.20	8	$0.40	108	$0.45	208	$0.50	308	$0.55	408
Smithfield City	$ 8.00	6	$0.50	Unlim	-	-	-	-	-	-
South Willard	$22.00	17	$0.75	Unlim	-	-	-	-	-	-
Tremonton City	$13.00	13	$1.13	Unlim	-	-	-	-	-	-

- **Encourage lower water use without causing a shortfall in system revenues**. To avoid revenue shortfalls, the rate structure should provide a consistent base charge that is set to cover all fixed cost -- those costs that do not vary with the amount of water delivered. It will cover all debt service, insurance, personnel, etc. that must be paid regardless of how much water is taken from the system. All customers pay this charge whether they use any water or not. Variable costs - those costs that vary with the amount of water delivered - should be covered by the volume charge, or what is often called the overage rate. Revenue from this part of the rate structure will vary with the amount of water delivered to customers and should cover the costs of all energy, treatment chemicals, etc. used in delivery of the water.

- **Identify water waste, reward efficient use and penalize excessive use**. In larger communities with more sophisticated billing and a customer relation's staff, water use targets can become part of the conservation program with the combination of available weather station technologies and computer billing programs. With targets in place for each customer, water over-use is readily identified, as are exemplary water efficient behaviors.

- **Produce additional revenue from penalty rates that can be used to fund needed water conservation programs and capital improvements**. Water conservation comes at a cost. This cost can be added to the commodity portion of the rate, raising the price of each unit of water delivered to the customer's meter. Additional revenue generated by the penalty portions of the rate structure should be placed in a dedicated account and used to pay for water conservation programs, new wells, storage tanks, and other capital improvements as needed.

- **Communicate through a water bill the cost of wasted water directly to the customer**. The ideal water bill would present the following information with each issuance: a target usage based on weather, landscaped area, and indoor water use; the amount of water delivered above (or below) the target use; and the rate (price) charged for the target usage and any excess. With this information, the customer is equipped with the information needed to make informed decisions about such things as landscape changes, spraying the driveway, washing the car, filling the pool, and long showers.

- **Provide a person or staff member to respond to customer calls for help in reducing water usage.** Individual home owners who desire

TABLE 15
Rate-payers cost per 1000 gallons for Selected Communities

Agency	Use Rate (GPCD)	Monthly Use*	Base Rate	limit	Block 1 Rate	Block 1 Usage	Block 1 cost	Total Bill	Cost per 1000 Gallons
Garland City	251	30.1	$12.75	15	$0.50	15.1	$7.55	$20.30	$0.67
Hyde Park City	190	22.8	$26.00	10	$0.50	12.8	$6.40	$32.40	$1.42
Hyrum City	450	54.0	$8.00	10	$0.45	44.0	$19.80	$27.80	$0.51
Logan City	292	35.0	$8.95	3	$0.55	32.0	$17.60	$26.55	$0.76
Millville City	245	29.4	$17.00	0	$0.60	29.4	$17.64	$34.64	$1.18
Newton Town	312	37.4	$15.50	20	$0.30	17.4	$5.20	$20.72	$0.55
North Logan City	177	21.2	$7.11	0	$1.57	21.2	$33.28	$40.39	$1.91
Perry City	273	32.8	$15.50	15	$0.95	17.8	$16.91	$32.41	$0.99
Portage	287	34.4	$15.00	Unlim	-	-	-	$15.00	$0.87
Providence City	238	28.6	$19.25	10	$0.40	18.6	$7.44	$26.69	$0.93
Richmond City	261	31.3	$19.60	10	$0.72	21.3	$15.34	$34.94	$1.12
River Heights	357	42.8	$22.20	8	$0.40	34.8	$13.92	$36.12	$0.84
Smithfield City	230	27.6	$8.00	6	$0.50	21.6	$10.82	$18.80	$0.68
South Willard	265	31.8	$22.00	17	$0.75	14.8	$11.10	$33.10	$1.04
Tremonton City	258	31.0	$13.00	13	$1.13	18.0	$20.34	$33.34	$1.08
Average									$0.97

*Monthly Use (in 1000 gallons) = Use Rate x 4 people x 30 days / 1000 gallons

to stay within their targets and request assistance can be given a soil probe and taught to properly irrigate their lawns and gardens through home water use audits. Trained irrigation specialists can provide water audits for golf courses, school grounds, and other large areas.

Water rates can be structured in several ways, each of which upholds the above principles in whole or in part. A series of three tables is use to demonstrate two common rate structures and one that is relatively new to system managers and customers in Utah.

Table 16
Seasonal Block Rate Structure
All quantities are measured in thousands of gallons (Kgal)

Month	Usage	Base Rate	Regular Rate $.70	Seasonal Rate $1.00	Total
Jan	9	$10.00	$6.30	-	$16.30
Feb	10	$10.00	$7.00	-	$17.00
Mar	11	$10.00	$7.70	-	$17.70
Apr	30	$10.00	$21.00	-	$31.00
May	45	$10.00	$31.50	-	$41.50
Jun	58	$10.00	-	$58.00	$68.00
Jul	63	$10.00	-	$63.00	$73.00
Aug	60	$10.00	-	$60.00	$70.00
Sep	34	$10.00	$23.80	-	$33.80
Oct	20	$10.00	$14.00	-	$24.00
Nov	10	$10.00	$7.00	-	$17.00
Dec	9	$10.00	$6.30	-	$16.30
TOTALS	**359**	**$120.00**	**$124.60**	**$181.00**	**$425.60**

The seasonal block rate structure increases the price of water during times of higher demand when most peaking problems and wear and tear on the infrastructure occur. Salt Lake City Public Utilities implemented a seasonal block rate in 1994 for the summer months of June, July and August, and has continued this program with great success. Table 16 shows an example of seasonal rate structures.

The increasing block rate structure is more complex, but simple to administer if the water supplier has adequate computer billing software. Table 17 shows how this rate structure works in a hypothetical family for one year.

The seasonal block and increasing block rates can be constructed to encourage efficient water use without causing a shortfall in revenue. This can be accomplished by setting the base charge to consistently cover fixed costs and setting the commodity charge to cover variable costs.

However, neither rate structure has the ability to identify wasteful or inefficient behaviors. In both situations it is possible to create a water bill that will educate the customer regarding how much water is being used. A charge for each overage may encourage more efficient use. Both rate structures can be supported by staff who respond to customer calls for help in reducing water use.

The ascending block rate provides a water use target for each customer based on size of landscaped area, number of people, and plant water needs measured by weather stations. Irrigation application efficiency is also accounted for in setting the targets. Table 18 shows how this rate structure works in a hypothetical family for one year.

TABLE 17
Increasing Block Rate Structure
All quantities are measured in thousands of gallons (Kgal)

Month	Usage	Base	Overage			
			0 – 10 $0.70	10 - 20 $.90	Over 20 $1.00	Total
Jan	9	$10.00	$6.30	-	-	$16.30
Feb	10	$10.00	$7.00	-	-	$17.00
Mar	11	$10.00	$7.00	-	-	$17.00
Apr	30	$10.00	$7.00	$9.00	-	$26.00
May	45	$10.00	$7.00	$9.00	$25.00	$51.00
Jun	58	$10.00	$7.00	$9.00	$38.00	$64.00
Jul	63	$10.00	$7.00	$9.00	$43.00	$69.00
Aug	60	$10.00	$7.00	$9.00	$40.00	$66.00
Sep	34	$10.00	$7.00	$9.00	$14.00	$40.00
Oct	20	$10.00	$7.00	$9.00	-	$26.00
Nov	10	$10.00	$7.00	-	-	$17.00
Dec	9	$10.00	$6.30	-	-	$16.30
TOTALS	**359**	**$120.00**	**$82.60**	**$63.00**	**$160.00**	**$425.60**

TABLE 18
Ascending Block Rate Structure
Usage and Target Usage measured in thousands of gallons (Kgal)

Month	Usage	Base	Target Usage	Et.[1]	Rate 1[2] @ $.80	Rate 2[3] @ $1.00	Rate 3[4] @ $2.00	Rate 4[5] $4.00	Total
Jan	9	$10.00	10	0	$7.20				$17.20
Feb	10	$10.00	10	0	$8.00				$18.00
Mar	11	$10.00	10	0	$8.00	$1.00			$19.00
Apr	30	$10.00	28	2.0	$22.40	$2.00			$34.40
May	45	$10.00	39	3.3	$31.20	$6.00			$47.20
Jun	58	$10.00	47	4.2	$37.60	$9.40	$3.20		$60.20
Jul	63	$10.00	50	4.6	$40.00	$10.00	$6.00		$66.00
Aug	60	$10.00	47	4.2	$37.60	$9.40	$7.20		$64.20
Sep	34	$10.00	30	2.3	$24.00	$4.00			$38.00
Oct	20	$10.00	19	1.0	$15.20	$1.00			$26.20
Nov	10	$10.00	10	0	$8.00				$18.00
Dec	9	$10.00	10	0	$7.20				$17.20
Totals	**359**	**$120.00**	**321**	**21.6**	**$246.40**	**$42.80**	**$16.40**		**$425.60**

Days in Billing Period = 30 Appl. Effic. = .65 Indoor use = 70 gpcd Irr. Area = .21 ac. Family Size = 5
1) Estimated Evapotranspiration in inches
2) Conservative or efficient Use
3) Normal Use
4) Inefficient Use
5) Irresponsible Use

Commercial Water Conservation

Water conservation within commercial organizations is also essential, and can provide the business with extra revenue formerly wasted on excess water use. Some commercial endeavors, such as laundries, have already implemented water conservation to reduce energy costs. Often businesses hire a landscape contractor to maintain their grounds. Frequently there is a lack of communication between the business owner and the landscaper. Consequently commercial sites are often over-watered by a significant amount. Water pricing incentives would likely further motivate commercial businesses to re-evaluate their water conservation efforts.

Industrial Water Conservation

Water pricing incentives will likely have a positive impact upon discretionary water use within industries that receive water from public water systems. Making production processes more water-efficient can also save large amounts of discretionary water.

Education

An effective water conservation program requires an active water education component. Since everyone is a water user, water education is directed at changing individual attitudes and habits. Every public agency or private organization concerned with planning, developing or distributing water can make a difference through efforts in this regard. In Utah, water conservation materials are regularly mailed to schools, water-user organizations and individuals upon request. These materials are part of a water education program sponsored by the Division of Water Resources. Other conservation objectives of the division's education program include water-efficient landscaping, proper gardening techniques, and the promotion of more efficient appliances such as low-flow toilets and low-flow showerheads. Assistance in implementing conservation-oriented water rate structures is also available. Water education programs will continue to be directed at students in elementary and secondary schools through a consortium of public education and water agencies throughout the state.